PATENT SPECIFICATION

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(54) SEGMENTALLY BONDED NON-WOVEN FABRICS

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, Imperial Chemical House, Millbank, London SW1P 3JF, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to bonded non-woven fabrics and, in particular, to the production of segmentally bonded non-woven fabrics.

Many methods for the production of bonded non-woven fabrics have been proposed including the application to a non-woven web of adhesives or heat if thermoplastic materials are included in the web. In particular it is known to apply heat and pressure for bonding at limited areas of the web by passing it through the nip between calender rolls at least one of which is heated and carries a pattern of lands and depressions on its surface. Where the fabric is nipped between the roll surfaces heavy or primary bonding is effected at separated segments of the fabric resulting in a segmentally bonded fabric. Of the roll pair used as the calender rolls either one roll or both rolls may carry patterns of lands and depressions; in the former case the second roll being a plain unpatterned one. In the former case the plain roll especially when directly heated also tends to cause some less heavy or secondary bonding over the remainder of the fabric where it has not been nipped between the rolls. This overall secondary bonding on one face of the fabric tends to stiffen the fabric. In the latter case when both rolls are patterned it is known to use patterns in the form of circumferential rings or in the form of helices which cannot intermesh. Calendering with such rolls does not cause secondary bonding over the whole of a fabric face but only at those places in each face where the fabric has been touched by a land on one side only. However this more limited secondary bonding is achieved at the expense of the disadvantage that only a limited range of regular patterns of primary bonds can be produced, at the land cross over points as the rolls rotate.

Calendering a web between two rolls each bearing patterns of lands which were maintained sufficiently accurately in register with each other could produce any desired pattern or both primary and secondary bonding; but maintenance of such accurate register is not practicable, or is at best very expensive, when using rolls big enough to produce wide fabrics and with lands small enough to produce fabrics with useful properties and pleasing appearance.

The physical and visual properties of the bonded fabric are related to the amount of bonding some directly and some inversely and accordingly the properties obtained in a fabric are the result of a compromise. Hitherto available fabrics have not achieved the best combination of properties for all purposes, in particular as fabrics for apparel purposes where properties closely resembling conventional woven and knitted fabrics and an attractive appearance are desired. Such known fabrics generally carried a geometrically regular pattern of primary bonds which is aesthetically unattractive.

According to this invention we provide a process for the production of a thermally segmentally bonded fabric wherein a fibrous web including at least some distributed thermally bondable material is passed through the nip between co-operating calender rolls at least one of which is heated to a bonding temperature and at least one of which has on its surface a pattern of lands formed by groups of lands of different density.

Fibrous webs for use in this invention may comprise staple fibres or continuous filaments or even mixtures of these. Staple fibre webs are conveniently prepared by carding a mass of staple fibres or they may be prepared by a random air laying method and continuous filament webs may be prepared by a conventional air laying method using a jet of air to transport the filaments from some source and to spread them in a random array on a foraminous conveyor. An electrostatic charge

mary bonds will exhibit a different affinity for dyestuff from that shown by the less heavily bonded or unbonded parts of the fabric. Such colouration may be effected simultaneously with bonding by passing a dye transfer sheet through the calender nip with the fibrous web as described in our copending cognate patent applications 17239/75, 2172/76 and 2887/76.

Pattern groups of different density may take various forms. For example they may be realistic in that several groups together represent real objects, such as flowers for example or they may be surrealistic or non-representational of real objects while still presenting an overall pattern of different density groups.

The accompanying drawings illustrate patterns defined by groups of different density wherein,

Fig. 1 represents a pattern formed of lands of circular cross section, and

Fig. 2 represents a pattern formed of linear lands which may be circumferential rings or helices or longitudinal splines.

Referring to Fig. 1 this represents a portion of a floral pattern wherein floral representations of different tones are shown by land groups of different density against a background of uniform density.

Fig. 2 is a representation of a floral and leaf pattern wherein the different density groups are produced by variation of the thickness of the line patterns.

Fig. 3 is a chess-board pattern also formed by variation of the thickness of the line patterns.

In an embodiment of this invention a carded web weighing 141.6 g/m^2 consisting of 3.3 decitex 58 mm staple fibres of polyamide conjugated filaments (50:50 by weight sheath/core nylon 6/nylon 66) is passed at 3 m/min through the nip between calender rolls each at a surface temperature of 215°C and with a linear nip pressure of 180 lb/in. The upper roll is patterned as in Fig. 3 the thicker lands having a width of 1.1 mm and the thinner lands a width of 0.5 mm. Each group consists of seven lines in a 12.7 mm square and the % roll surface area formed by these lines is 60% and 27% for the denser and less dense areas respectively. The lower roll is a thin walled tube which yields sufficiently to equalise any small surface irregularities and thus equalise nip pressure along the nip. This roll bears a simple pattern of longitudinal splines having a width of 0.8 mm, there being 16 such splines per 25 mm of roll circumference corresponding to a land area of 50%. The combined effect on the fibrous web passed between these rolls is to produce 30% primary bonded area in the dense regions and 14% in the lighter regions and to produce a bonded fabric having the following properties:—

Breaking load, Kg	22.2 (MD)
Extension at break, %	27 (MD)
Tear strength, Kg	1.7 (MD)
	1.9 (CD)
Bending length, cm	5.1 (MD)
	3.7 (CD)

MD=Machine direction:
CD=Cross direction.

These measurements are made by the following methods:

Bending Length

The bending length is measured according to British Standard BS3356:1961. Bending length (cm) is the cube root of the ratio of flexural rigidity to the weight per unit area.

Tensile Strength

The tensile strength is measured as the breaking load of 25 mm wide strips of fabric when strained at a constant rate of 100 mm/min (on an Instron, RTM, tensile tester) from an initial gauge length of 100 mm. The extension at break is simultaneously recorded.

Tear Strength

The load required to tear a sample is measured in an Instron Tensile Tester. A rectangular sample 100 mm by 50 mm is prepared by making a straight cut in the centre of a shorter side for 75 mm parallel to the long sides. The two 25 mm wide ends so formed are secured, one in each of the Instron jaws which are spaced 50 mm apart. On separating the jaws at right angles to the plane of the fabric at 50 mm/min the sample is torn and the maximum load (or the mean level if several peaks were noted) is recorded.

WHAT WE CLAIM IS:—

1. A process for the production of a thermally segmentally bonded fabric wherein a fibrous web including at least some distributed thermally bondable material is passed through the nip between co-operating calender rolls at least one of which is heated to a bonding temperature and at least one of which has on its surface a pattern of lands formed by groups of lands of different density.

2. A process according to claim 1 wherein the groups of lands of different density differ in the size of the lands in the different groups.

3. A process according to claim 1, wherein the groups of lands of different density differ in the number of lands per unit area of the different groups, the lands being of uniform size.

4. A process according to any one of claims 1—3 wherein both rolls bear a pattern of lands formed by groups of lands of different density.

5. A process according to any one of claims 1—3 wherein one roll is a plain roll.

6. A process according to any one of claims

1499178 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

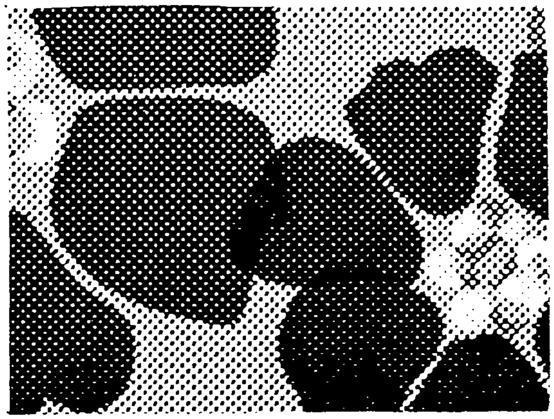

Fig. 1

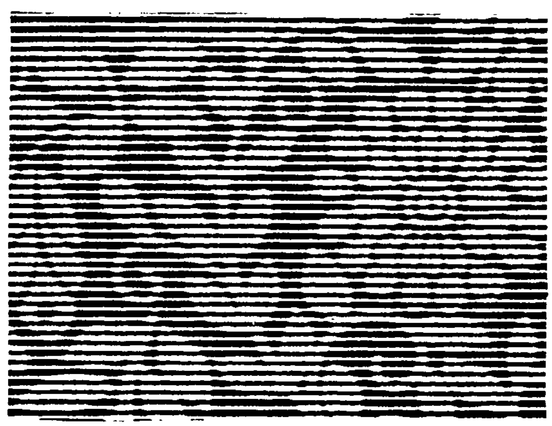

Fig. 2